

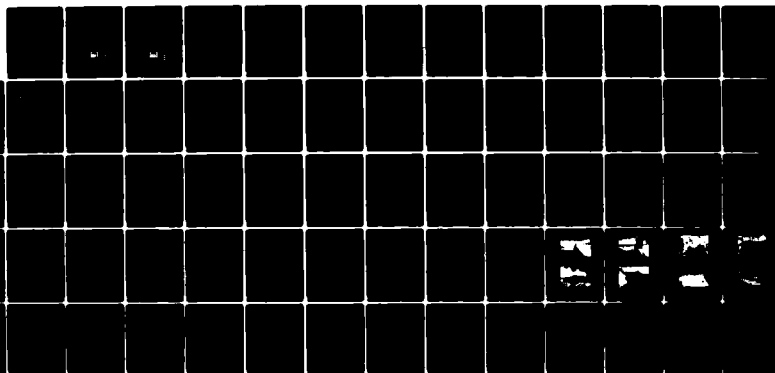
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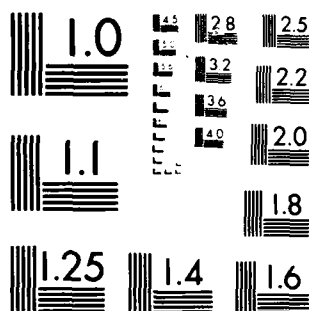
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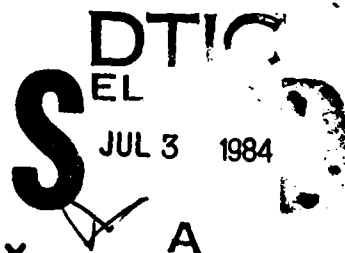
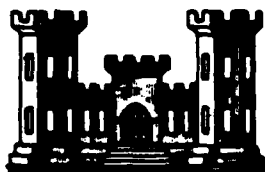
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SAUGATUCK RIVER BASIN
EASTON, CONNECTICUT

ASPETUCK RES. DAM
CT 00021

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00021	2. GOVT ACCESSION NO. ADA142 735	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Saugatuck River Basin, Easton, Conn. Aspetuck Res. Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE Sept. 1980
		13. NUMBER OF PAGES 63
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Saugatuck River Basin, Easton, Conn. Aspetuck Res. Dam		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The Aspetuck Reservoir Dam is an earth embankment which is 1,160 ft. long and 11 ft. high with a concrete gravity spillway which is 500 ft. long. The earth embankment has a core wall and it and the spillway are built on two rows of wooden sheet piling that extends 16 ft. into the ground. There is a 36 inch. low level discharge pipe to the downstream area and a 24 inch low level discharge pipe into an adjacent 8 ft. diameter conduit. This conduit is a diversion into another reservoir with an independent watershed. The drainage area is 17.6 square miles and the reservoir has 311 acre-feet of available storage. The assessment of the dam is based on visual inspection.		

ASPETUCK RESERVOIR DAM

CT 00021

SAUGATUCK RIVER BASIN
EASTON, CONNECTICUT



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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:

NEDED

DEC 19 1980

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the Aspetuck Reservoir Dam (CT-00021) Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, the Bridgeport Hydraulic Company.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,

Incl
As stated

WILLIAM E. HODGSON, JR.
Colonel, Corps of Engineers
Acting Division Engineer

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification Number:	CT 00021
Name:	Aspetuck Reservoir Dam
Town:	Easton
County and State:	Fairfield County, Connecticut
Stream:	Aspetuck River
Date of Inspection:	June 10, 1980

BRIEF ASSESSMENT

The Aspetuck Reservoir Dam is an earth embankment which is 1,160 feet long and 11 feet high with a concrete gravity spillway which is 500 feet long. The earth embankment has a core wall and it and the spillway are built on two rows of wooden sheet piling that extends 16 feet into the ground. There is a 36-inch low level discharge pipe to the downstream area and a 24-inch low level discharge pipe into an adjacent 8-foot diameter conduit. This conduit is a diversion into another reservoir with an independent watershed. The drainage area is 17.6 square miles and the reservoir has 311 acre-feet of available storage.

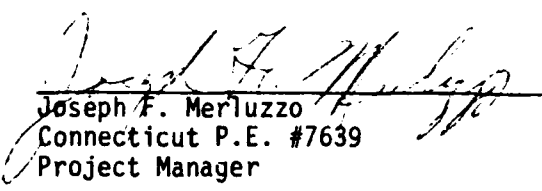
The assessment of the dam is based on visual inspection, available drawings, past operational performance and hydraulic/hydrologic computations. The dam is judged to be in fair condition with several areas that require attention. These areas include seepage through the dam, spillway and around the abutments and several areas of the spillway where concrete has spalled and the joints are in poor condition.

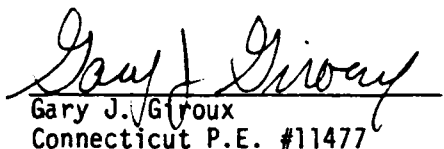
The dam is classified as small and has a significant hazard potential in accordance with guidelines established by the Corps of Engineers. The test flood outflow for this dam is 3,235 cfs which corresponds to the 100-year

flood. The spillway capacity is 11,300 cfs or 3.5 times the test flood outflow. The test flood outflow will flow over the spillway by 1.4 feet.

It is recommended that the owner engage the services of a qualified registered engineer experienced in the design of dams to investigate the seepage through the dam and around the abutments and to recommend a means of repairing the concrete of the spillway. It is also recommended that the owner remove all vegetation from the spillway; repair all cracked and spalled concrete; establish a formal warning system; and initiate an annual technical inspection.

The owner should implement the recommendations and remedial measures indicated above and in greater detail in Section 7 within one year after receipt of this Phase I Inspection Report.


Joseph F. Merluzzo
Connecticut P.E. #7639
Project Manager


Gary J. Groux
Connecticut P.E. #11477
Project Engineer

This Phase I Inspection Report on Aspentuck Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Aramast Mahtesian

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Richard J. DiBuono

RICHARD DIBUONO, CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar
JOE B. FRYAR

Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Inspections. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Inspection is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Inspection; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the Spillway Test Flood is based on the estimated Probable Maximum Flood for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and variety of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Inspection does not include an assessment of the need for fences, gates, "no trespassing" signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with Occupational Safety and Health Administration's (OSHA) rules and regulations is also excluded.

TABLE OF CONTENTS

	<u>Page</u>
Letter of Transmittal	
Brief Assessment	
Review Board Page	
Preface	i
Table of Contents	ii-iv
Overview Photo	
Location Map	

Section

1. PROJECT INFORMATION

1.1 General	1
a. Authority	1
b. Purpose of Inspection	1
1.2 Description of Project	1
a. Location	1
b. Description of Dam and Appurtenances	2
c. Size Classification	3
d. Hazard Classification	3
e. Ownership	3
f. Operator	3
g. Purpose of Dam	3
h. Design and Construction History	3
i. Normal Operational Procedure	3
1.3 Pertinent Data	4

2. ENGINEERING DATA

2.1 Design Data	8
2.2 Construction Data	8
2.3 Operation Data	8
2.4 Evaluation of Data	8

3. VISUAL INSPECTION

3.1 Findings	9
a. General	9
b. Dam	9
c. Appurtenant Structures	9
d. Reservoir Area	10
e. Downstream Channel	10

<u>Section</u>	<u>Page</u>
3.2 Evaluation	10
4. OPERATIONAL AND MAINTENANCE PROCEDURES	
4.1 Operational Procedures	11
a. General	11
b. Description of any Warning System in Effect . .	11
4.2 Maintenance Procedures	11
a. General	11
b. Operating Facilities	11
4.3 Evaluation	11
5. EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES	
5.1 General	12
5.2 Design Data	12
5.3 Experience Data	12
5.4 Test Flood Analysis	13
5.5 Dam Failure Analysis	13
6. EVALUATION OF STRUCTURAL STABILITY	
6.1 Visual Observations.	15
6.2 Design and Construction Data	15
6.3 Post-Construction Changes	15
6.4 Seismic Stability	15
7. ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES	
7.1 Dam Assessment	16
a. Condition	16
b. Adequacy of Information	16
c. Urgency	16
7.2 Recommendations	16

<u>Section</u>	<u>Page</u>
7.3 Remedial Measures	17
a. Operation and Maintenance Procedures . . .	17
7.4 Alternatives	17

APPENDICES

- APPENDIX A - Inspection Checklist
- APPENDIX B - Engineering Data
- APPENDIX C - Photographs
- APPENDIX D - Hydrologic and Hydraulic Computations
- APPENDIX E - Information as Contained in the National
Inventory of Dams



ASPETUCK RESERVOIR DAM

PHASE I INSPECTION REPORT
ASPETUCK RESERVOIR DAM CT 00021

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority - Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Storch Engineers has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to Storch Engineers under a letter of March 6, 1980 from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-80-C-0035 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection -

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location - The Aspetuck Reservoir Dam is located in the western section of the Town of Easton, Fairfield County, Connecticut approximately

3.5 miles north of the Merritt Parkway (U.S. Route 15) - Route 58 intersection and 3,000 feet north of the Route 58 - Route 136 intersection. The coordinates of the dam are approximately 41°-14' north latitude and 73°-19' west longitude. The dam is located on the Aspetuck River and is approximately 5.5 miles upstream from the confluence with the Saugatuck River.

b. Description of Dam and Appurtenances - The Aspetuck Reservoir Dam is an earth embankment dam approximately 1,160 feet long and 11 feet high with a concrete gravity spillway.

The earth embankment portion is approximately 660 feet long and 11 feet high. There is a core wall that is 17 feet deep with the top of the core wall 1 foot below the top of the embankment. The core wall is founded on 2 rows of sheet piling that extends 16 feet below the wall.

The spillway is a concrete gravity type with an ogee section that is 500 feet long and 8 feet high. As with the core wall it too is founded on two rows of sheet piling that extends down to the same elevation. The toe of the spillway has a mortared stone apron.

There is a 36-inch blowoff that discharges into the Aspetuck River and a 24-inch blowoff that discharges into an 8-foot diameter diversion conduit that empties into the Hemlock Reservoir. This reservoir is in a separate watershed. The spillway crest for the Hemlock Reservoir Dam is at the same elevation as that of the Aspetuck Reservoir Dam. With the two spillways at the same elevation, the capacity of this conduit is restricted.

Controls for the blowoff are on the upstream face. Controls for the diversion conduit are at the downstream end of the conduit just as it enters the Hemlock Reservoir.

c. Size Classification - The Aspetuck Reservoir Dam has a maximum height of 11 feet and a maximum capacity of 311 acre-feet at the top of the dam. In accordance with the Recommended Guidelines for Safety Inspection of Dams established by the Corps of Engineers, the dam is classified as small (height less than 40 feet, storage less than 1,000 acre-feet).

d. Hazard Classification - The Aspetuck Reservoir Dam is classified as having a significant hazard potential. Failure of the dam could cause the loss of a few lives. Approximately 2,000 feet downstream are two homes in which the first floor will experience approximately 2 feet of flooding when the dam fails with the pool at spillway crest level. Estimated flow and water depth at this location just prior to failure is practically nonexistent and just after failure is 4,406 cfs at 6.0 feet.

e. Ownership - Aspetuck Reservoir Dam is owned by:

Bridgeport Hydraulic Company
835 Main Street
Bridgeport, Connecticut
(203) 367-6621

f. Operator - Operating personnel are under the direction of:

Mr. Edward Stangl
Bridgeport Hydraulic Company
835 Main Street
Bridgeport, Connecticut
(203) 367-6621

g. Purpose of Dam - The dam impounds the Aspetuck Reservoir which is used for water supply in the Bridgeport, Connecticut area.

h. Design and Construction History - The Aspetuck Reservoir Dam was designed by Albert B. Hill, Consulting Engineer, New Haven, Connecticut in 1913. The exact date the dam was constructed is not known but is assumed to have been soon after design. There have been no major modifications or additions to the dam since.

i. Normal Operating Procedure - Water level in the Aspetuck Reservoir is controlled by means of a blowoff and diversion tunnel to Hemlock Reservoir. Maintenance personnel make daily checks of water level.

1.3 Pertinent Data

a. Drainage Area - The Aspetuck Reservoir drainage basin is located in the Towns of Redding, Bethel, Newtown and Easton, Connecticut and is irregular in shape. The area of the drainage basin is 17.6 square miles. Less than 5 percent of the drainage basin is natural storage. The topography is hilly with elevations ranging from 225 NGVD at the dam to 850 NGVD. More than 60 percent of the drainage area is wooded and open space and the remainder developed.

b. Discharge at Damsite - There are no records available for discharge at the dam.

(1) Outlet works (conduit) size:	36
Invert elevation (feet above NGVD):	217
Discharge Capacity at top of dam:	125 cfs
(2) Maximum known flood at damsite: (Oct. 1955)	unknown
(3) Ungated spillway capacity at top of dam:	11,300 cfs
Elevation (NGVD):	228.0
(4) Ungated spillway capacity at test	
flood elevation:	3,235 cfs
Elevation (NGVD):	226.4
(5) Gated spillway capacity at normal pool	
elevation:	N/A
Elevation (NGVD):	N/A

(6)	Gated spillway capacity at test flood elevation:	N/A
	Elevation:	N/A
(7)	Total Spillway capacity at test flood elevation:	3,235 cfs
	Elevation (NGVD):	226.4
(8)	Total project discharge at top of dam:	11,425 cfs
	Elevation (NGVD):	228.0
(9)	Total project discharge at test flood elevation:	3,360 cfs
	Elevation (NGVD):	226.4
c.	Elevation (feet above NGVD)	
(1)	Streambed at toe of dam:	217
(2)	Bottom of cutoff:	198.5
(3)	Maximum tailwater:	225
(4)	Normal pool:	225
(5)	Full flood control pool:	N/A
(6)	Spillway crest (ungated):	225
(7)	Design surcharge (original design):	227
(8)	Top of dam:	228
(9)	Test flood surcharge:	226.4
d.	Reservoir (length in feet)	
(1)	Normal pool:	5,000
(2)	Flood control pool:	N/A
(3)	Spillway crest pool:	5,000
(4)	Top of dam:	5,500
(5)	Test flood pool:	5,250

e.	Storage (acre-feet)	
	(1) Normal pool:	147
	(2) Flood control pool:	N/A
	(3) Spillway crest pool:	147
	(4) Top of dam:	311
	(5) Test flood pool:	227
f.	Reservoir Surface (acres)	
	(1) Normal pool:	55
	(2) Flood control pool:	N/A
	(3) Spillway crest:	55
	(4) Test flood pool:	58
	(5) Top of dam:	60
g.	Dam	
	(1) Type:	earth embankment
	(2) Length:	1,160 feet
	(3) Height:	11 feet
	(4) Top width:	15 feet
	(5) Side slopes:	2:1
	(6) Zoning:	unknown
	(7) Impervious	
	Core:	concrete
	(8) Cutoff:	two rows of wooden sheet piling
	(9) Grout curtain:	unknown
	(10) Other:	N/A
h.	Diversion and Regulating Tunnel	N/A

i. Spillway

- | | |
|---|-----------------------------------|
| (1) Type: | concrete ogee |
| (2) Length of weir: | 500 feet |
| (3) Crest elevation (without flashboard): | 225 |
| (4) Gates: | N/A |
| (5) U/S channel: | earth, riprap |
| (6) D/S channel: | masonry apron/
natural channel |
| (7) General: | N/A |

j. Regulating Outlets

- | | |
|------------------------------|------------------------|
| (1) Invert elevation (NGVD): | 217 |
| (2) Size: | 36 inches |
| (3) Description: | cast iron pipe |
| (4) Control Mechanism | manually operated gate |
| (5) Other: | N/A |

SECTION 2 - ENGINEERING DATA

2.1 Design Data

No design computations are available for this dam, however, the following drawings are available:

- (a) Plans for Aspetuck River Diversion Works, Town of Easton, Connecticut, Bridgeport Hydraulic Company, April, 1913 by Albert B. Hill, Consulting Engineer, New Haven, Connecticut (Appendix B - Plates 1 and 2).

2.2 Construction Data

The dam was constructed around 1913. It is not known who constructed the dam and there are no records.

2.3 Operation Data

The reservoir is used for water supply. Most of the water is diverted to the Hemlock Reservoir. The only operating records for this dam are daily readings of water level.

2.4 Evaluation of Data

- a. Availability - The information noted above is readily available from the files of the Bridgeport Hydraulic Company.
- b. Adequacy - The data made available along with the visual inspection, past performance history and hydraulic/hydrologic assumptions were adequate to assess the condition of the facility.
- c. Validity - The field inspection revealed that the dam was constructed essentially as the data states, however, some of the information must be verified.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General - The visual inspection was conducted on June 10, 1980 by members of the engineering staff of Storch Engineers, D. Baugh and Associates and Matthews Associates. A copy of the visual inspection checklist is contained in Appendix A of this report. Selected photos of the dam are contained in Appendix C.

In general, the overall condition of the dam and its appurtenant structures is fair.

b. Dam - The earth embankment is in good condition with no settlement or bulges. The top and downstream faces of the dam are grass covered and are well maintained (Photos 1 and 2). At the western spillway abutment, there is some erosion of the embankment (Photo 9). This erosion is due to trespassing with the aid of stormwater runoff. There is a wet spot below the western embankment (Photo 4). The amount of water seeping is not measurable but the ground is very spongy.

c. Appurtenant Structures - The spillway is a concrete ogee spillway that is 8 feet high and 500 feet long (Photos 1, 3 and 8). In some areas, the concrete of the spillway is in poor condition. The top longitudinal joint shows evidence of rust staining and efflorescence along most of its length. The interfaces of the lateral joints with the top longitudinal joint has deteriorated to the point that local failures are visible. Holes in the concrete are up to 6 inches deep and in some areas reinforcing is visible.

Seepage was noted through several joints and vegetation was noted growing in others. Cracks were observed in the concrete at regular intervals. These cracks were sealed in the past with tar which has since deteriorated.

There is a masonry apron at the toe of the spillway which was intact with no signs of distress (Photo 8). The western abutment and wingwall has a crack extending from the top of the spillway to the top of the dam. This crack was repaired in the past, but has since reopened with the mortar coming loose (Photo 7). Seepage was noted coming from around both the east and west wingwalls of the spillway. The amount of flow was negligible. There is a pipe coming from under the west wingwall. This pipe does not show on the original drawings and it is not known when it was installed. Flow out of this pipe was estimated to be 25 gallons per minute.

The blowoff pipe is a 36-inch diameter pipe that outlets at the toe of the spillway (Photo 3). The blowoff gate is on the upstream face and is operable. The diversion inlet to Hemlock Reservoir is well maintained and cleaned regularly (Photo 3).

d. Reservoir Area - The area immediately adjacent to the reservoir is wooded and gently sloping. The shoreline is maintained and shows no signs of sloughing or erosion. A rapid rise in the water level of the pond will not endanger life or property.

e. Downstream Channel - The downstream channel is a natural channel of rock and gravel. The area adjacent to the downstream channel is heavily overgrown with brush.

3.2 Evaluation

Overall, the general condition of the dam is fair. The visual inspection revealed items that lead to this assessment, such as:

- a. Wet areas at the toe of the embankment
- b. Seepage through the spillway and around the wingwalls
- c. Deterioration of the concrete and the poor condition of the joints

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General - The operation of this facility is for water supply and is kept as high as possible.

b. Description of Any Warning System in Effect - There is a warning system but it is not written.

4.2 Maintenance Procedures

a. General - Maintenance of the dam is on a routine basis. The only area that is lacking is the concrete of the spillway.

b. Operating Facilities - The gate and the discharge pipe are operable.

4.3 Evaluation

There is regularly scheduled maintenance except for concrete repair, as shown by the condition of the dam. A formal warning system should be developed.

SECTION 5 - EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

The Aspetuck Reservoir Dam is an earth embankment dam with a concrete gravity spillway. The dam is 1,160 feet long and 11 feet high. The spillway is an ogee spillway that is 500 feet long and is 3 feet lower in elevation than the dam embankment. A 36-inch discharge pipe goes through the base of the dam with the gate valve on the upstream face of the dam. This valve is operable.

The watershed encompasses 17.6 square miles and is 60 percent wooded and open space with the remainder developed. The topography is rolling with terrain rising 600 feet from the spillway crest.

The pond has a total capacity of 311 acre-feet at the top of the earth embankment and 147 acre-feet at the spillway crest. Therefore, there is approximately 164 acre-feet (.175 inches per acre) of storage available. The test flood outflow for this dam is 3,235 cfs and the spillway capacity is 11,300 cfs or approximately 350 percent of the flood.

5.2 Design Data

No design data for the original dam is available. Computations for this dam were developed and used for this report.

5.3 Experience Data

No historical data for recorded discharges or water surface elevation is available for this dam; however, the dam has withstood the floods of the 1930's and 1950's and more recently in January of 1979. The storm of record in this area is October, 1955. The exact discharge over the dam for this storm is not known.

5.4 Test Flood Analysis

Based on the Recommended Guidelines for Safety Inspection of Dams, the dam is classified as a small structure with a significant hazard potential. The test flood for these conditions ranges from the 50-year to 100-year flood. The 100-year flood was used for this dam because of the storage capacity.

The test flood inflow was calculated using an equation found in the Connecticut Department of Transportation Hydraulics and Drainage Manual (1973). This formula was developed as a fast means for developing flow throughout the State and is based on USGS gaging stations. The test flood inflow by this method is 3,275 cfs.

The routing procedure was performed using the method established by the Corps of Engineers' guidelines and gives an approximate outflow of 3,235 cfs. The spillway capacity of the dam is approximately 11,300 cfs or 3.5 times the test flood outflow. The test will flow over the spillway by 1.4 feet.

Storage behind the dam was assumed to begin at the elevation of the spillway crest. Storage was determined by an average area depth analysis. Capacity curves for the spillway were based on computations for an ogee spillway.

5.5 Dam Failure Analysis

A dam failure analysis was performed using the Rule of Thumb method in accordance with guidelines established by the Corps of Engineers. Failure was assumed to occur when the water level in the reservoir was at the top of the dam.

Downstream from the reservoir is a fairly broad floodplain with a flat basin slope. A majority of the flood prone area is open space. The first floor sills of two homes approximately 2,000 feet downstream are about 4 feet above streambed.

The spillway discharge just prior to dam failure is 11,300 cfs and will produce a depth of flow of approximately 9.2 feet 2,500 feet downstream from the dam. The calculated dam failure discharge is 12,270 cfs and will produce a depth of flow of approximately 9.5 feet 2,500 feet downstream from the dam or an increase in water depth at failure of approximately 0.3 feet. The failure analysis covered a distance of approximately 6,500 feet downstream where the depth of flow was calculated to be 6.2 feet.

Dam failure was also assumed to occur when the water level in the reservoir was at the spillway crest. Failure under this condition would create an instantaneous increase from no flow to flow several feet deep. Failure of the Aspectuck Reservoir Dam under these conditions could cause the loss of a few lives. Approximately 2,000 feet downstream are two homes that will experience approximately 2 feet of flooding when the dam fails. Estimated flow and water depth at this location is 4,406 cfs at 6.0 feet.

SECTION 6 - EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

The general structural stability of the dam is good as evidenced by the vertical, horizontal and lateral alignment. The concrete of the spillway show signs of spalling, seepage, cracking and efflorescence. The joints are in poor condition and they all need attention. The earth embankment portions of the dam also show no evidence of instability. The structural stability of the dam, however, can be affected by the items noted in Section 3.2.

6.2 Design and Construction Data

The dam was constructed around 1913 from plans prepared by Albert B. Hill, Consulting Engineer.

The design and construction data consists of plans showing elevations, profiles and sections of the dam. Upon verification, these plans have been used along with the visual inspection to evaluate the dam.

6.3 Post-Construction Changes

The only post-construction change is the pipe that comes from under the west wingwall. It is not known by whom, when or why the pipe was installed.

6.4 Seismic Stability

The dam is located in Seismic Zone 1 and in accordance with Recommended Phase I Guidelines does not warrant a seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition - After consideration of the available information, the results of the inspection, contact with the owner and hydraulic/hydrologic computations, the general condition of the Aspetuck Reservoir Dam is fair.

b. Adequacy of Information - The information available is such that an assessment of the safety of the dam should be based on the available data, the visual inspection results, past operational performance of the dam and its appurtenant structures and computations developed for this report.

c. Urgency - It is considered that the recommendations and remedial measures suggested below be implemented within one year after receipt of this Phase I Inspection Report.

7.2 Recommendations

The following recommendations should be carried out under the direction of a qualified registered engineer.

- a. Seepage in the vicinity of the toe of the earth embankment dam should be investigated further to determine its origin and monitored to determine any change.
- b. Seepage through the face of the spillway and around the wingwalls should be investigated further to determine its origin and monitored to determine any change.
- c. Deterioration of the concrete at the joint interface along the entire spillway face should be investigated to determine the cause and method of correction.

- d. Repair all cracked and spalled concrete.

Any recommendations made by the engineer should be implemented by the owner.

7.3 Remedial Measures

- a. Operation and Maintenance Procedures -

- (1) Remove all vegetation from the joints in the concrete spillway.
- (2) Clear the downstream channel of debris.
- (3) Erosion due to trespassing at the west abutment should be checked.
- (4) Institute a program of annual technical inspection by a qualified Engineer.
- (5) Plans for around-the-clock surveillance should be developed for periods of unusually heavy rains and a formal downstream warning system should be put into operation for use in the event of an emergency.

7.4 Alternatives

There are no practical alternatives to the above recommendations.

APPENDIX A
INSPECTION CHECKLIST

INSPECTION CHECK LIST

PARTY ORGANIZATION

PROJECT Aspetuck Reservoir Dam

DATE 6-10-80

TIME 1:00 p.m.

WEATHER Cloudy/Cool

W.S. ELEV. _____ U.S. _____ D.N.S.

PARTY:

- | | |
|--------------------------------------|---------------------------------------|
| 1. <u>J. Schearer, SE, Civil</u> | 6. <u>F. Austin, DBA, Civil</u> |
| 2. <u>K. Pudeler, SE, Civil</u> | 7. <u>J. Pozzato, MA, Mech/Elect.</u> |
| 3. <u>G. Giroux, SE, Hyd/Civil</u> | 8. _____ |
| 4. <u>S. Jordan, SE, Geo.</u> | 9. _____ |
| 5. <u>M. Haire, DBA, Geo/Struct.</u> | 10. _____ |

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>Dam Embankment</u>	<u>S. Jordan</u> <u>G. Giroux</u>	<u>Good</u>
2. <u>Intake structure</u>	<u>M. Haire</u> <u>P. Austin</u>	<u>Good</u>
3. <u>Control Tower</u>	<u>M. Haire</u> <u>K. Pudeler</u>	<u>Good</u>
4. <u>Mechanical</u>	<u>J. Pozzato</u> <u>M. Haire</u>	<u>Good</u>
5. <u>Spillway</u>	<u>P. Austin</u>	<u>Fair</u>
6. _____	_____	_____
7. _____	_____	_____
8. _____	_____	_____
9. _____	_____	_____
10. _____	_____	_____

INSPECTION CHECK LIST

PROJECT Aspetuck Reservoir Dam DATE 6-10-80

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	
Crest Elevation	Good
Current Pool Elevation	Good
Maximum Impoundment to Date	Good
Surface Cracks	None
Pavement Condition	N/A
Movement or Settlement of Crest	None
Lateral Movement	None
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Fair - Some cracking with poor quality patching
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Doesn't appear to be a problem
Vegetation on Slopes	Well Maintained
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection - Riprap Failures	None
Unusual Movement or Cracking at or near Toes	None visible
Unusual Embankment or Downstream Seepage	Could not determine source of water through drain in west abutment.
Piping or Boils	Water boiling up at toe near 1st joint from west abutment.
Foundation Drainage Features	One drain at west abutment
Toe Drains	None
Instrumentation System	None

INSPECTION CHECK LIST

PROJECT Aspetuck Reservoir Dam

DATE 6-10-80

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<p><u>CUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u></p> <p>a. Approach Channel</p> <p>Slope Conditions</p> <p>Bottom Conditions</p> <p>Rock Slides or Falls</p> <p>Log Boom</p> <p>Debris</p> <p>Condition of Concrete Lining</p> <p>Drains or Weep Holes</p> <p>b. Intake Structure</p> <p>Condition of Concrete</p> <p>Stop Logs and Slots</p>	<p>Underwater</p> <p>None</p> <p>Appears to be regularly cleared of debris</p> <p>Unknown</p> <p>Good</p> <p>Good - regularly cleared</p>

INSPECTION CHECK LIST

PROJECT Aspetuck Reservoir Dam

DATE 6-10-80

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWER</u>	
a. Concrete and Structural	
General Condition	Good
Condition of Joints	Good
Spalling	None
Visible Reinforcing	None
Rusting or Staining of Concrete	None
Any Seepage or Efflorescence	None
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	None
Cracks	None
Rusting or Corrosion of Steel	None in evidence
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	Good
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System in Gate Chamber	

INSPECTION CHECK LIST

PROJECT Aspetuck Reservoir Dam

DATE 6-10-80

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED

CONDITION

OUTLET WORKS - TRANSITION AND CONDUIT

N/A

General Condition of Concrete

Rust or Staining on Concrete

Spalling

Erosion or Cavitation

Cracking

Alignment of Monoliths

Alignment of Joints

Numbering of Monoliths

INSPECTION CHECK LIST

PROJECT Aspetuck Reservoir Dam

DATE 6-10-80

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Concrete	Good
Rust or Staining	None
Spalling	None
Erosion or Cavitation	None
Visible Reinforcing	None
Any Seepage or Efflorescence	None
Condition at Joints	Good
Drain holes	None
Channel	
Loose Rock or Trees Overhanging Channel	Yes - overgrown with brush and trees
Condition of Discharge Channel	Rock and vegetation in channel / Fair

INSPECTION CHECK LIST

PROJECT Aspetuck Reservoir Dam DATE 6-10-80
 PROJECT FEATURE _____ NAME _____
 DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	Underwater
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Some silt
b. Weir and Training Walls	
General Condition of Concrete	Fair to Poor
Rust or Staining	Yes - coming from upper Longitudinal joint
Spalling	Yes - mostly at joint interfaces
Any Visible Reinforcing	Yes - at a joint that has opened
Any Seepage or Efflorescence	Yes - mostly at joints
Drain Holes	None
c. Discharge Channel	
General Condition	Fair to Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Heavy Brush
Floor of Channel	Appeared smooth and strong Possibly constructed of rock
Other Obstructions	None

INSPECTION CHECK LIST

PROJECT Aspetuck Reservoir DamDATE 6-10-80

PROJECT FEATURE _____

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SERVICE BRIDGE</u> a. Super Structure Bearings Anchor Bolts Bridge Seat Longitudinal Members Under Side of Deck Secondary Bracing Deck Drainage System Railings Expansion Joints Paint b. Abutment & Piers General Condition of Concrete Alignment of Abutment Approach to Bridge Condition of Seat & Backwall	N/A

APPENDIX B
ENGINEERING DATA

Information pertaining to the history, maintenance and modifications to the
Aspetuck Reservoir Dam as well as copies of past reports are located at:

The Bridgeport Hydraulic Company
835 Main Street
Bridgeport, Connecticut

ASPETUCK DAM

General

The dam and spillway appear structurally sound. The area is generally well kept except that the access road from Route 136 to the east end of the dam is in poor condition. There are numerous soft spots and holes along this dirt road. The east end of the dam must be inaccessible to all but four wheel drive vehicles during wetter conditions. Inspection was made December 8, 1977 with the reservoir up approximately one inch.

Tunnel Gatehouse

The building is in good condition. There is up to two inches of water in the southeast corner of the gatehouse. A steady stream is draining away to a small floor drain, but the water does not appear to be receding. There is a pane broken in the east window of the gatehouse. Some minor housekeeping would also be desirable.

Earthen Dike

This is in good condition.

Spillway

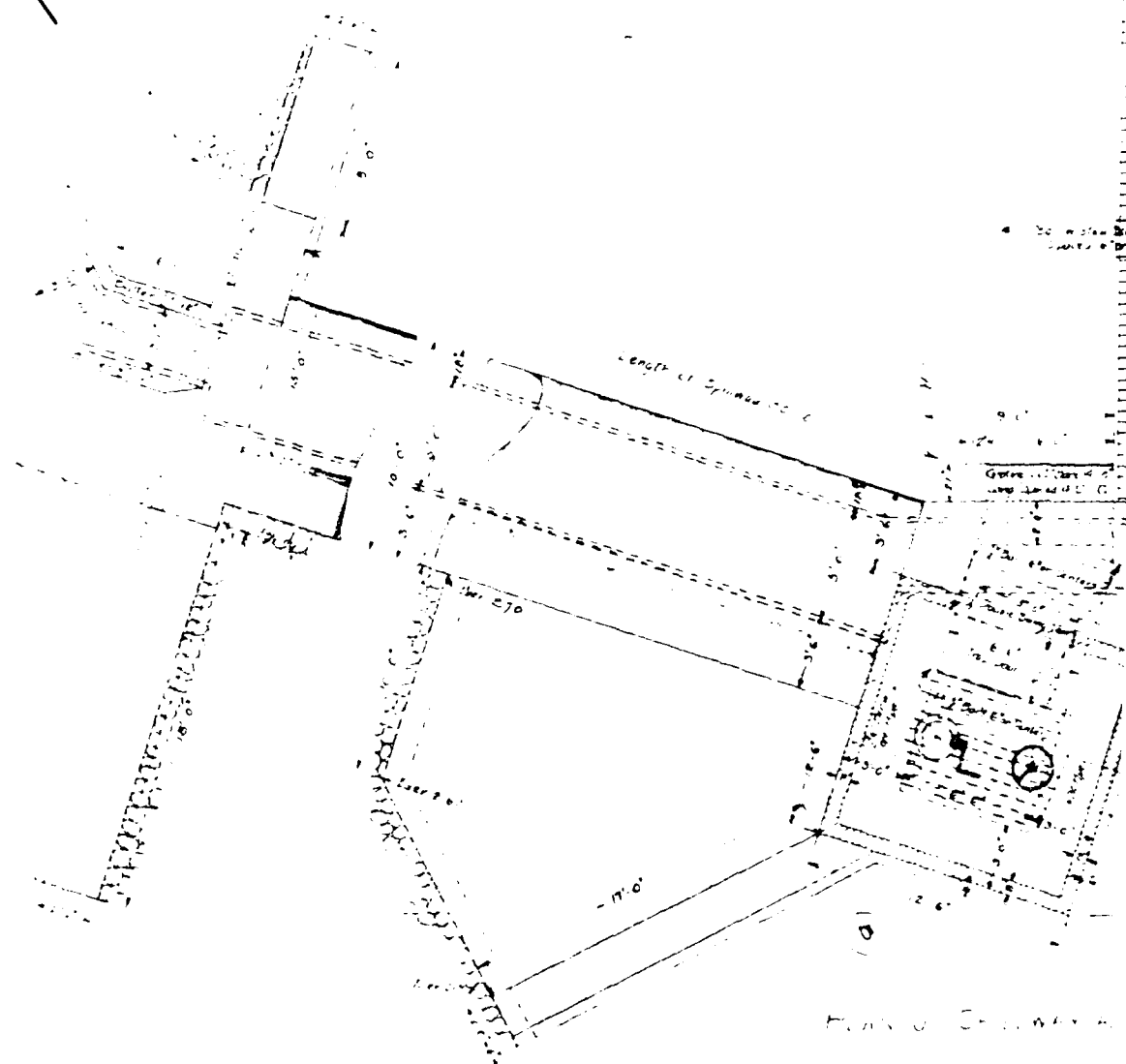
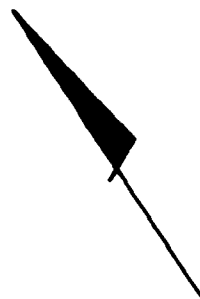
The center of the spillway is lower than the ends. Approximately 1 inch of water was going over the center while none was going over at other points. There are a number of both vertical and horizontal joints that have vegetation growing in there. This should be removed, and the joints sealed. Possibly some herbicide should also be applied to retard any regrowth.

Outlet Gatehouse

The door to the northwest gatehouse could not be opened. This should be corrected. The southeastern gatehouse is in poor condition. Vines have grown through the roof on the north side and there is a hole in the roof at the southwest corner. These should be fixed as soon as possible. There are some cracks in the walls but nothing serious. Some cleaning and minor housekeeping are also needed.

Outlet Apron

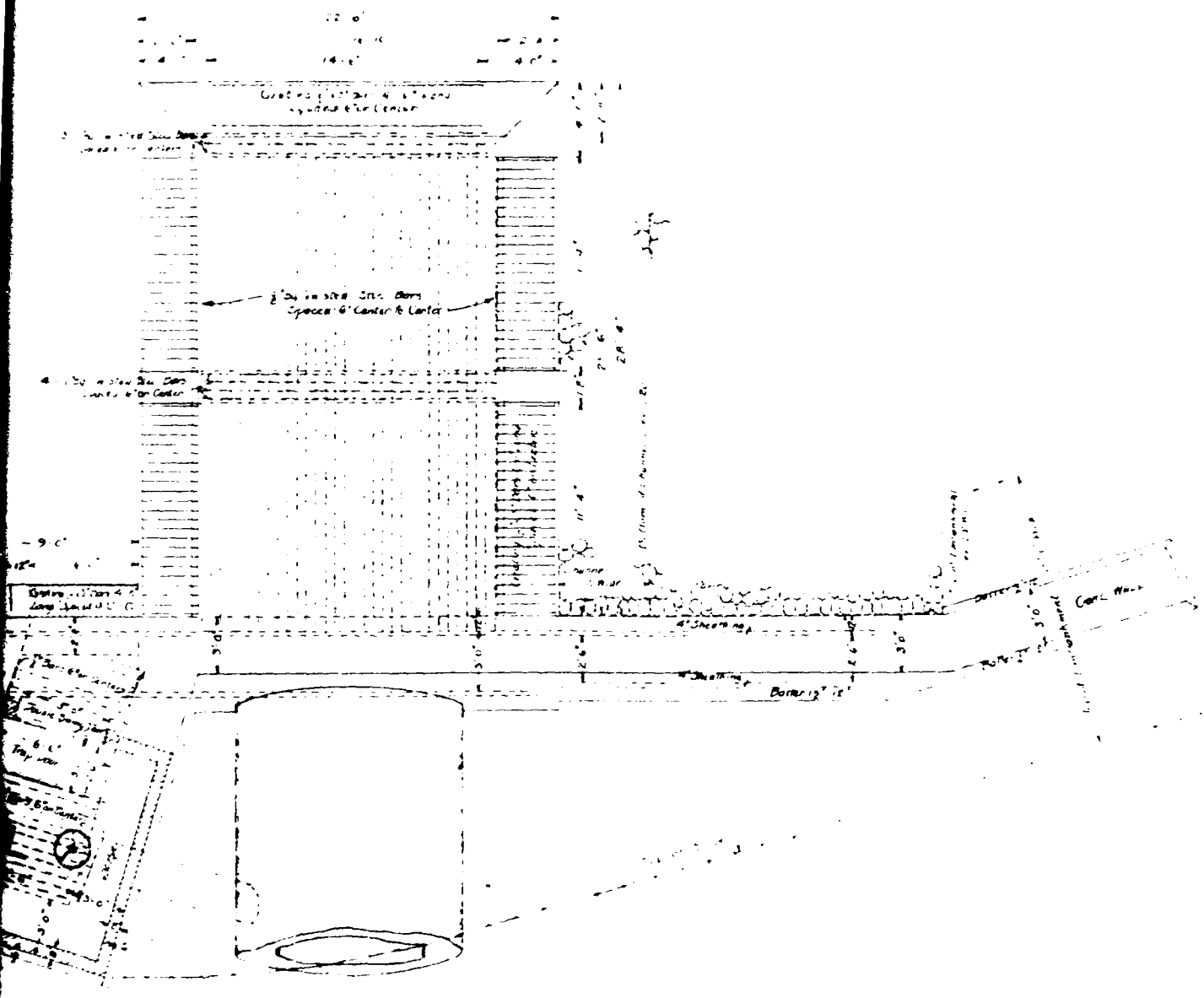
This is in good condition.



BRIDGEPORT HYDRAULIC CO.
PLANS FOR ASPETUCK RIVER DIVERSION WORKS
TOWN OF EASTON, CONN.

SCALE 1" = 10'

APRIL 1913



SPILLWAY AND CONDUIT INTAKE

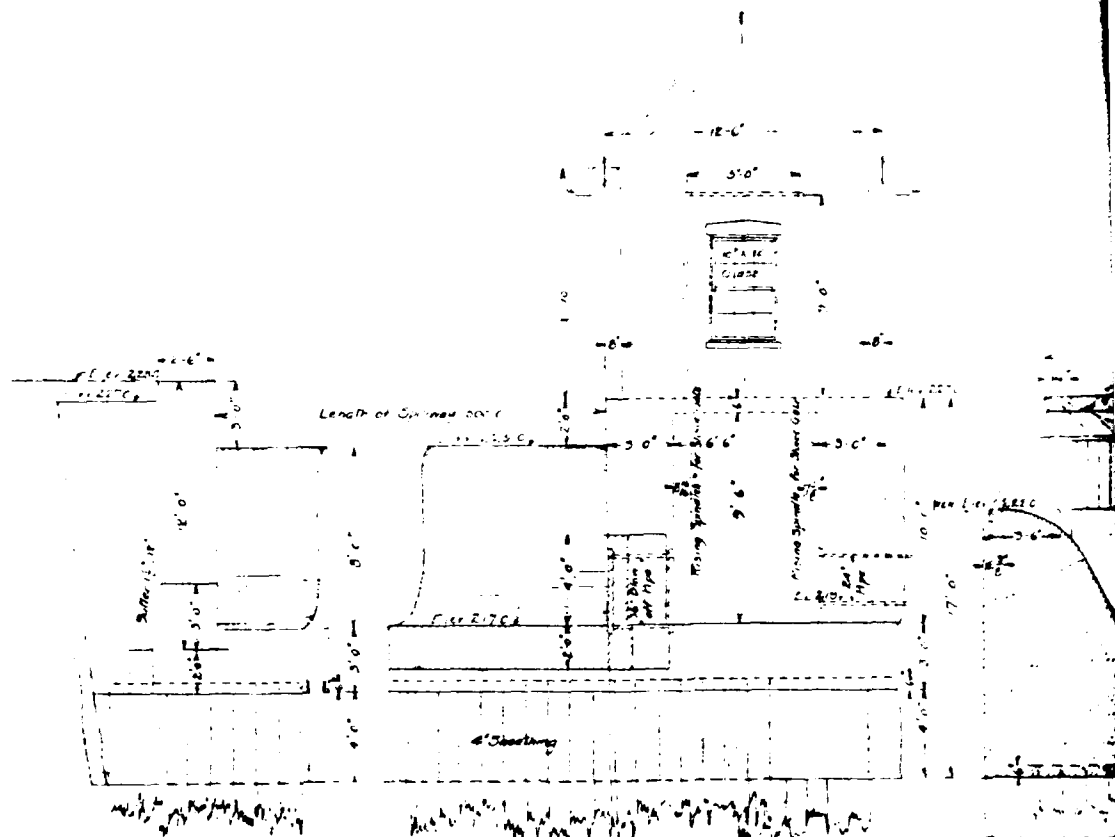
0
IN WORK

PHOTO REDUCED

PLATE I

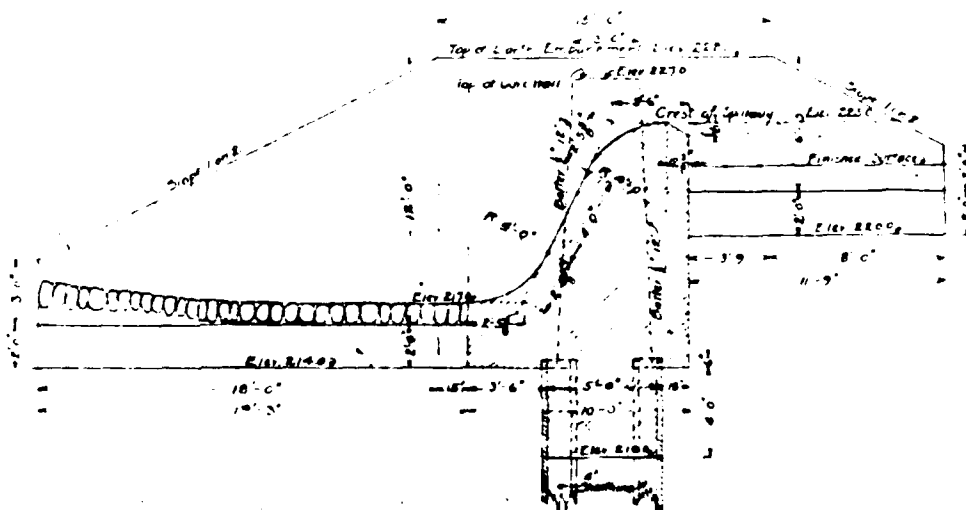
STORCH ENGINEERS WETHERSFIELD, CONNECTICUT			US ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM MASS
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS			
ASPETUCK RES. DAM			
			SCALE AS SHOWN
			DATE SEPTEMBER 1980

2

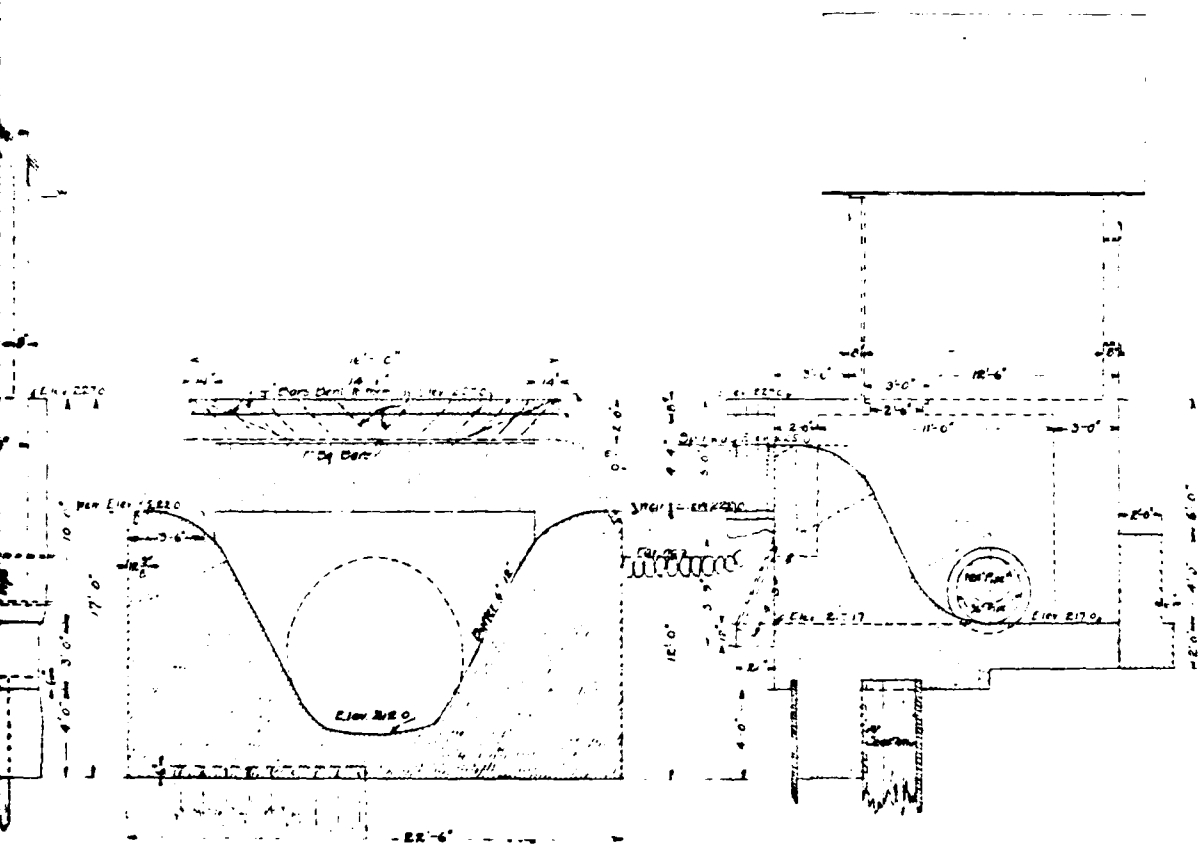


ELEVATION OF SPILLWAY AND BLOWOFF GATE HOUSE

CROSS SECTION



ELEVATION OF ABUTMENT AT WEST END OF SPILLWAY



CROSS SECTION OF CONDUIT INTAKE ON C-D

ELEVATION OF BLOWOFF GATE HOUSE ON A-B

BRIDGEPORT HYDRAULIC CO
PLANS FOR ASPETUCK RIVER DIVERSION WORKS
TOWN OF EASTON, CONN.

SCALE 1" = 1'

APRIL 1912

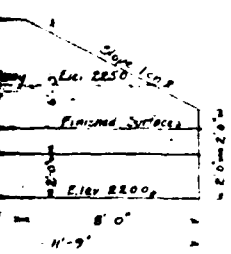


PLATE 2

STORCH ENGINEERS
WETHERSFIELD, CONNECTICUT

U.S. ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

ASPETUCK RES. DAM

PHOTO REDUCED

SCALE AS SHOWN
DATE SEPTEMBER 1980

APPENDIX C
PHOTOGRAPHS

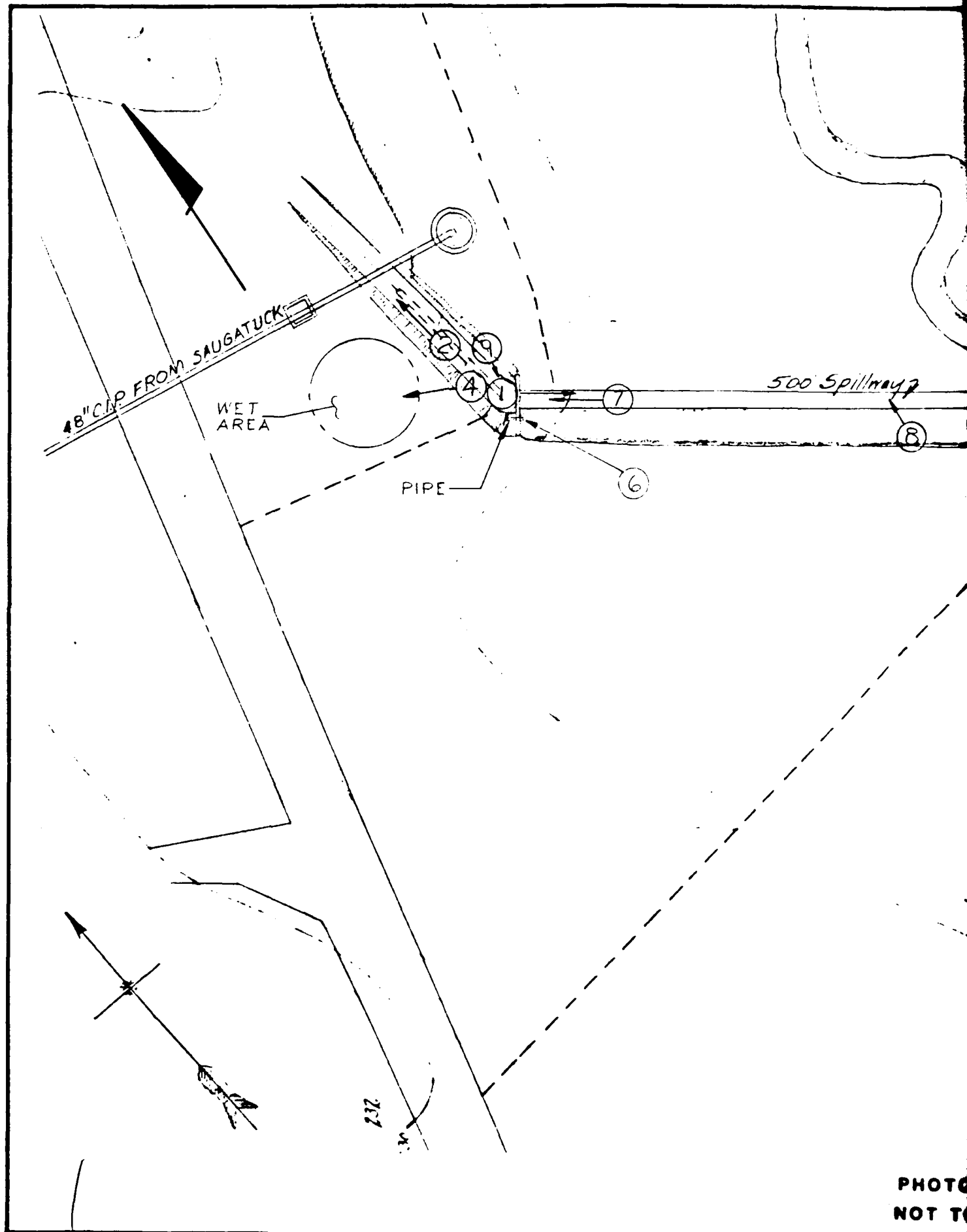


PHOTO
NOT TO

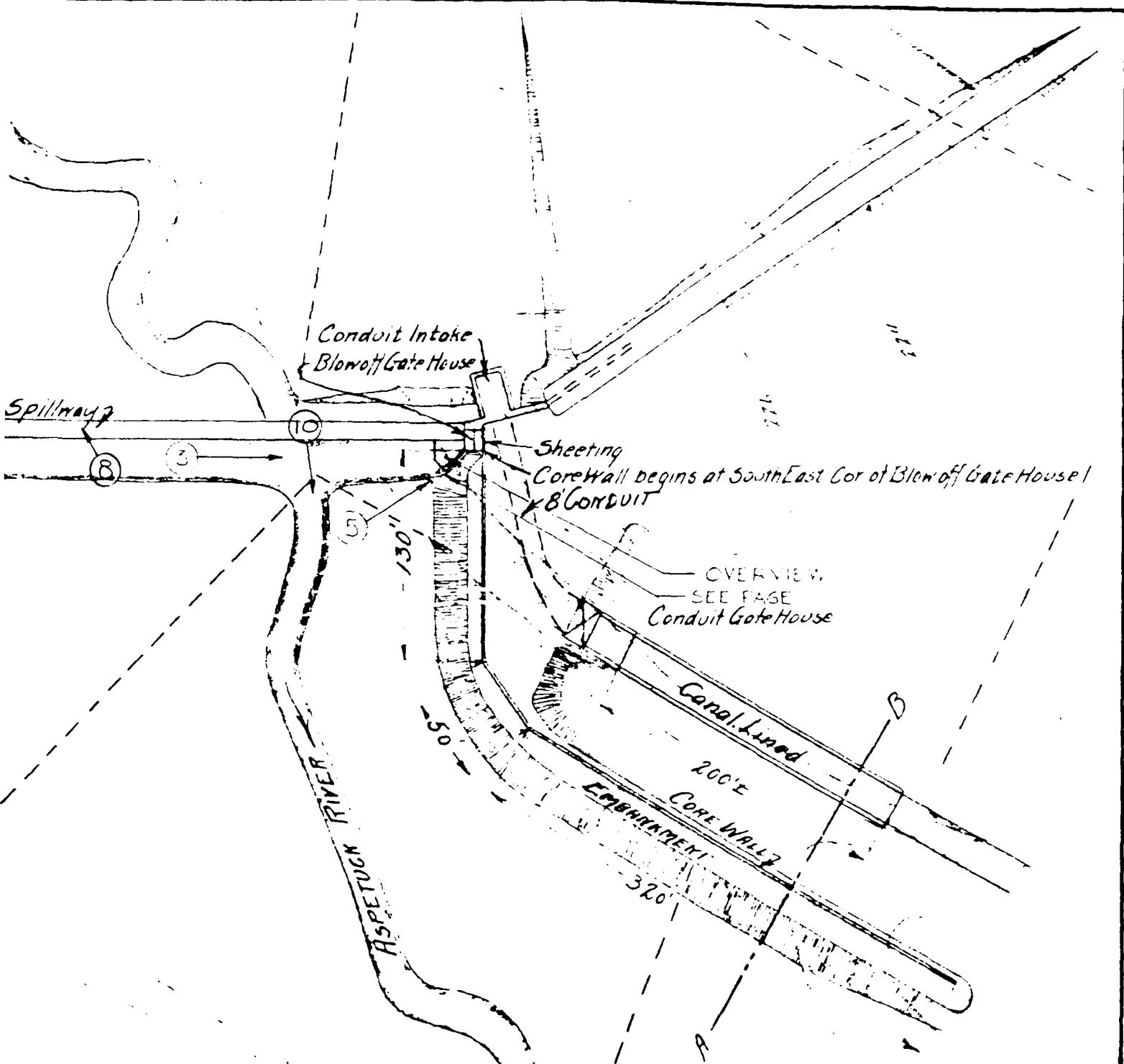


PHOTO LOCATION PLAN

PLATE 3

STORCH ENGINEERS

WETHERSFIELD CONNECTICUT

US ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

ASPETUCK RES. DAM

PHOTO REDUCED
NOT TO SCALE

SCALE AS SHOWN

DATE SEPTEMBER 1980



PHOTO 1
SPILLWAY CREST LOOKING EAST



PHOTO 2
WEST EMBANKMENT

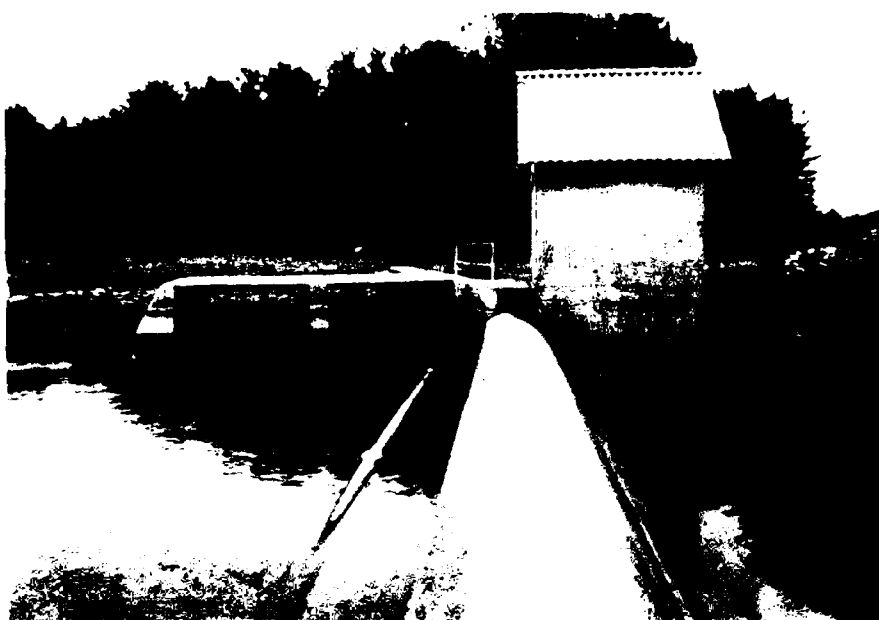


PHOTO 3
DIVERSION INLET - GATE HOUSE - BLOWOFF



PHOTO 4
WET AREA TOE OF WEST EMBANKMENT



PHOTO 5
SEEPAGE AROUND GATE HOUSE WINGWALL



PHOTO 6
DISCHARGE FROM PIPE THROUGH WEST ABUTMENT

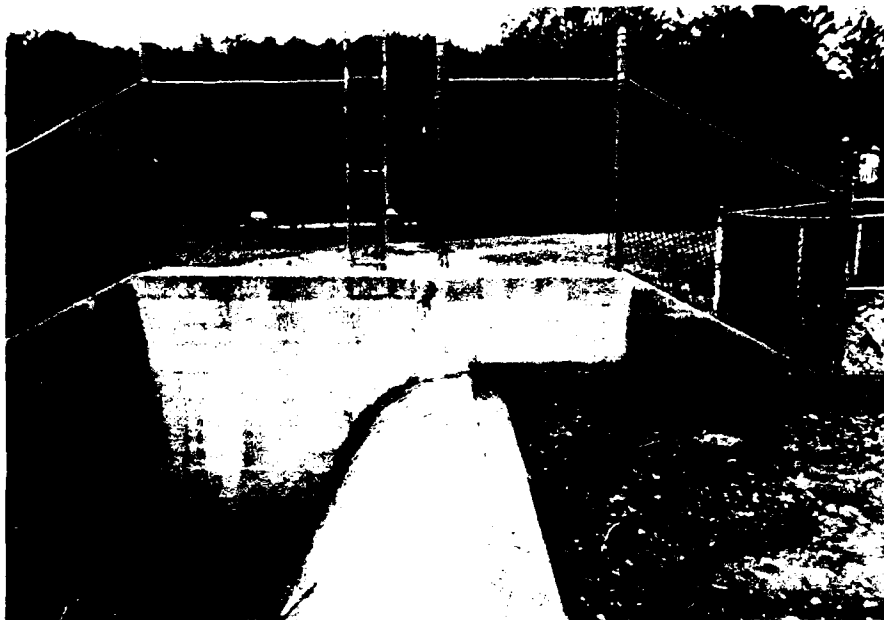


PHOTO 7
WEST ABUTMENT

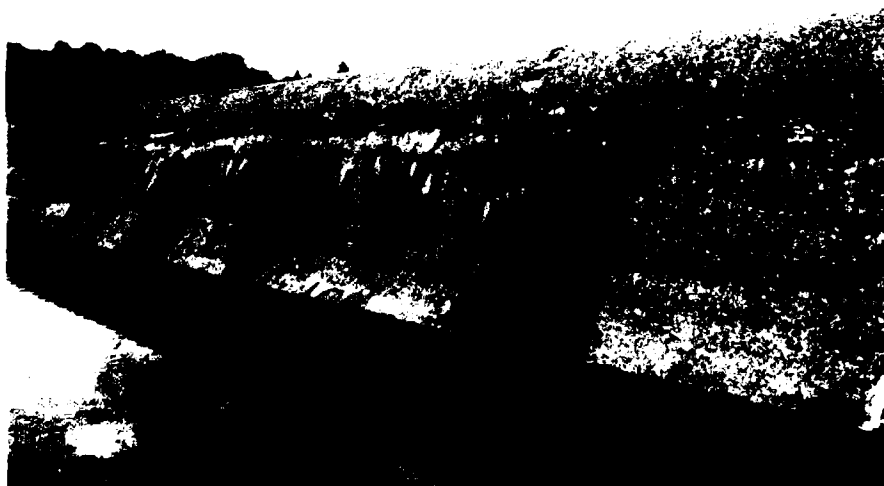


PHOTO 8
DOWNSTREAM FACE OF SPILLWAY



PHOTO 9
EROSION WEST EMBANKMENT



PHOTO 10
DOWNSTREAM - CHANNEL

APPENDIX D
HYDROLOGIC AND HYDRAULIC COMPUTATIONS

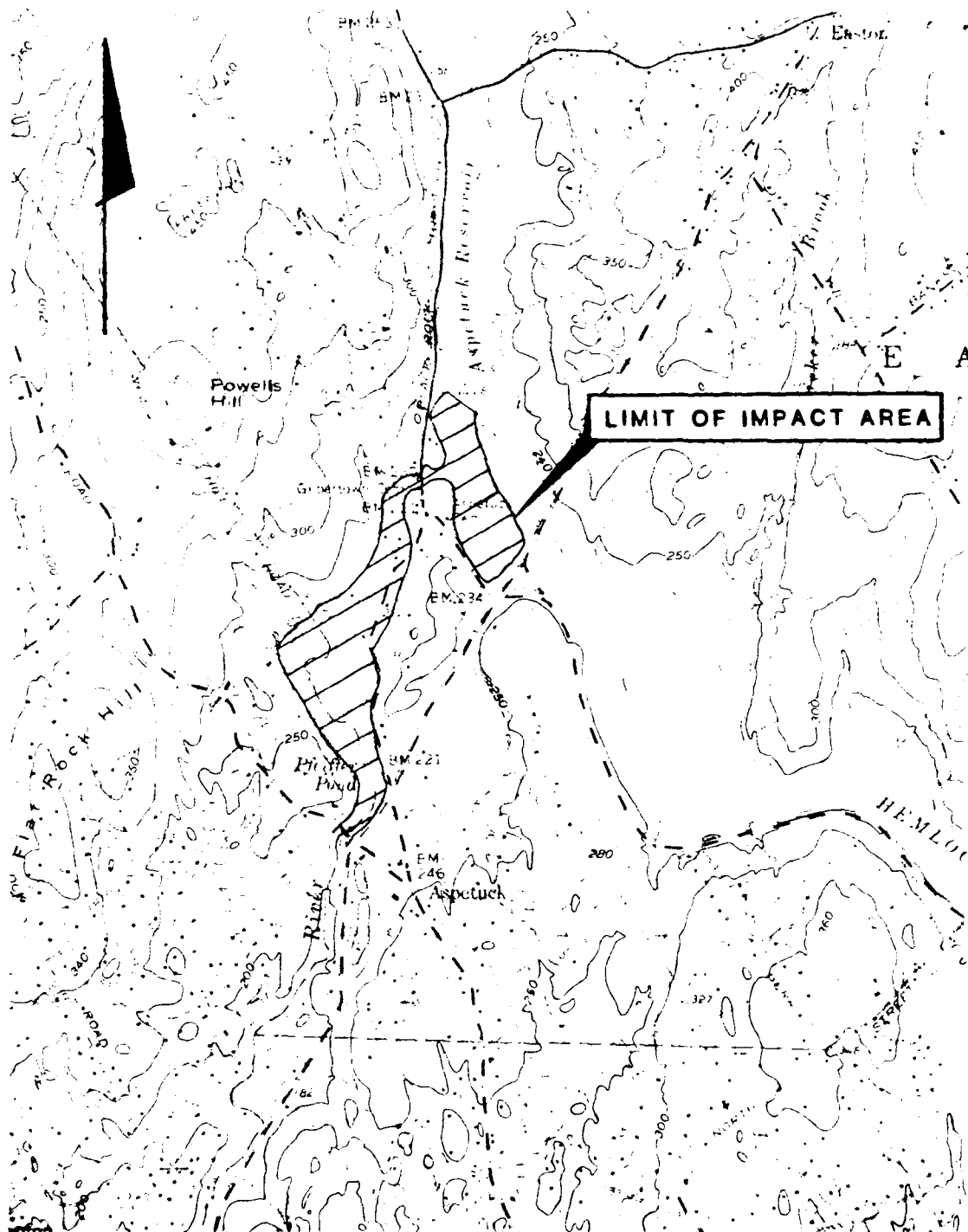


PLATE 4

STORCH ENGINEERS

WETHERSFIELD, CONNECTICUT

US ARMY ENGINEER DIVISION NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

ASPETUCK RES. DAM

SCALE 1:24000

SCALE AS SHOWN

DATE SEPTEMBER 1980

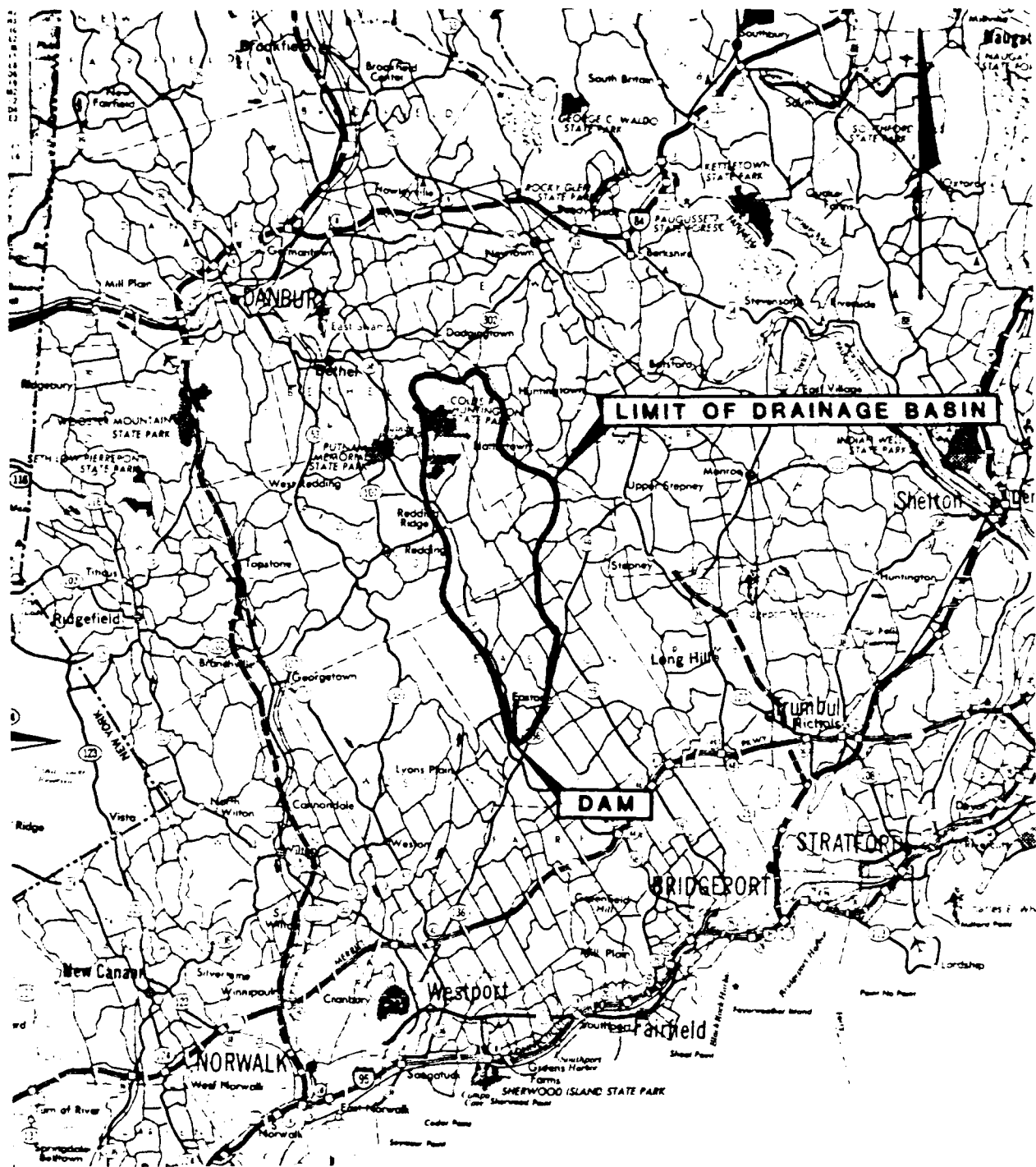


PLATE 5

<p>STORCH ENGINEERS WETHERSFIELD, CONNECTICUT</p>	<p>U.S. ARMY ENGINEER DISTRICT NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.</p>
<p>NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS</p>	
<p>ASPETUCK RES. DAM</p>	
<p>SCALE AS SHOWN DATE SEPTEMBER 1980</p>	

STORCH ENGINEERS
Engineers - Landscape Architects
Planners - Environmental Consultants

JOB Phase I Dam Inspection - #4463

SHEET NO. _____

OF _____

CALCULATED BY EGG

DATE 5/25/90

CHECKED BY _____

DATE _____

Determination of Test Flood

NAME OF DAM Aspetuck Reservoir Dam

DRAINAGE AREA 17.6 SM

INFLOW Size - Small

Hazard - Low

Use 100 yr freq.

$$Q_{100} = 3.10 A^{.79} *$$

$A = DA \text{ in SM}$

$$Q_{100} = 3.10 (17.6)^{.79} = 3275 \text{ cfs}$$

Estimating the effect of surcharge storage on the Maximum Probable Discharges

1. $Q_{p1} = \underline{3275} \text{ cfs}$

2a. $H_1 = \underline{226.45} \text{ (elev.)}$

b. $STOR_1 = \underline{.085}''$

c. $Q_{p2} = Q_{p1} (1 - STOR_1/E) = \underline{3220} \text{ cfs}$

3a. $H_2 = \underline{226.41}$ $STOR_2 = \underline{.055}''$

b. $STOR_A = \underline{.085}''$

$Q_{PA} = \underline{3220} \text{ cfs}$

$H_A = \underline{226.41}$

$STOR_A = \underline{.055}''$

Test Flood = 3220 cfs

Capacity of the spillway when the pond elevation is at the top of the dam

$Q = \underline{11300} \text{ cfs or } \underline{350} \% \text{ of the Test Flood}$

D-1

* Formula found in Conn DOT Drainage Manual (1973)
Based on USGS Gages throughout the State

STORCH ENGINEERS
Engineers - Landscape Architects
Planners - Environmental Consultants

JOB Phase I Dam Inspection 4463

SHEET NO. _____ OF _____

CALCULATED BY GJG DATE 6/10/80

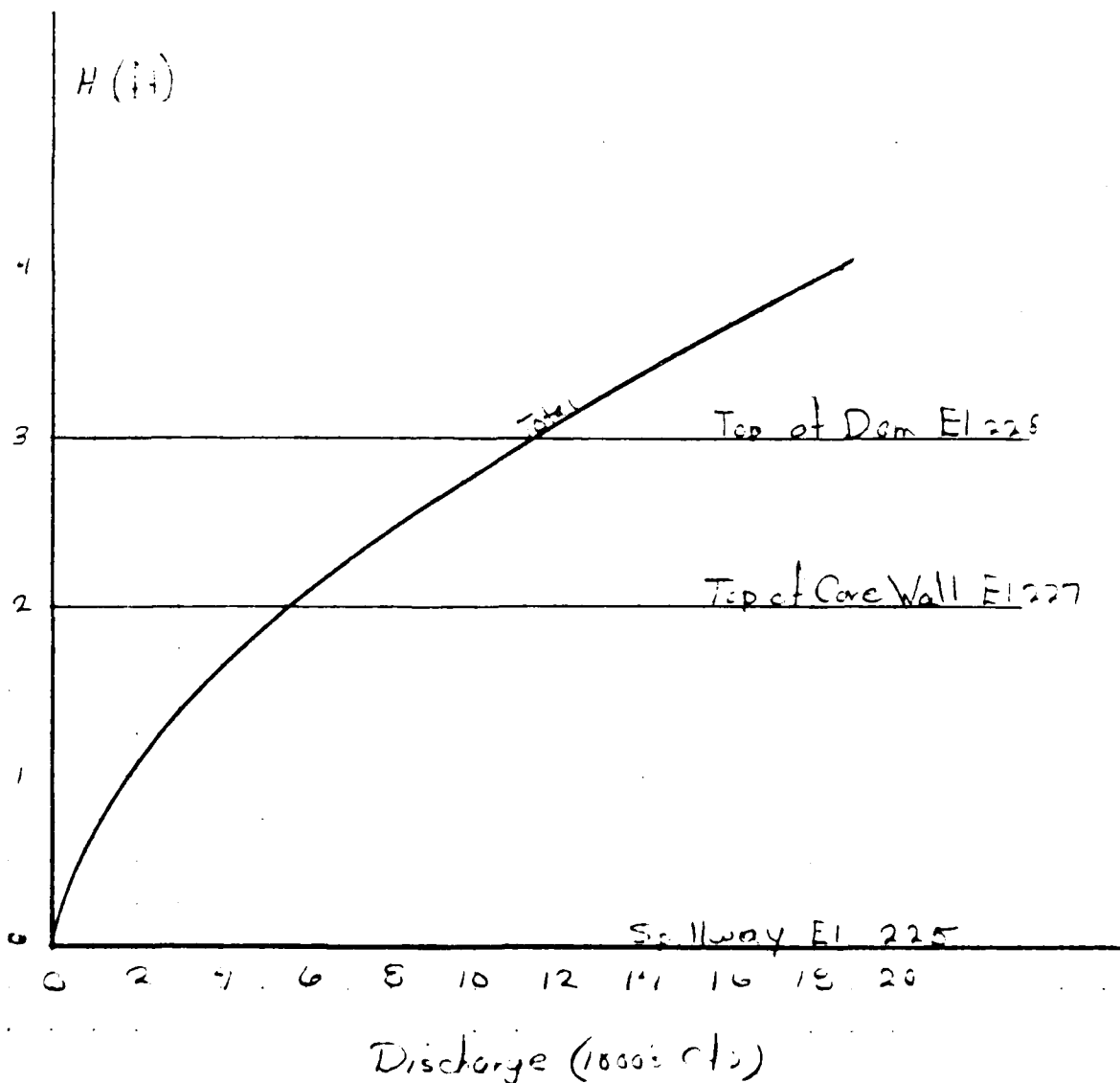
CHECKED BY _____ DATE _____

Stage Discharge

NAME OF DAM Aspetuck Res Dam

$$Q = CLH^{3/2}$$

Elev	Spillway I				Spillway II				Dam				QT
	C	L	H	Q	C	L	H	Q	C	L	H	Q	
		500	0										
3.55			1	0	1775								1775
3.9			2		5500								5500
4.2			3		10400				2.63	150	1	400	11300
4.37			4		17500				2.63	160	2	1100	16000



STORCH ENGINEERS
Engineers - Landscape Architects
Planners - Environmental Consultants

JOB Phase I Dam Inspection 4463

SHEET NO. _____

OF _____

CALCULATED BY EL

DATE 5/15/77

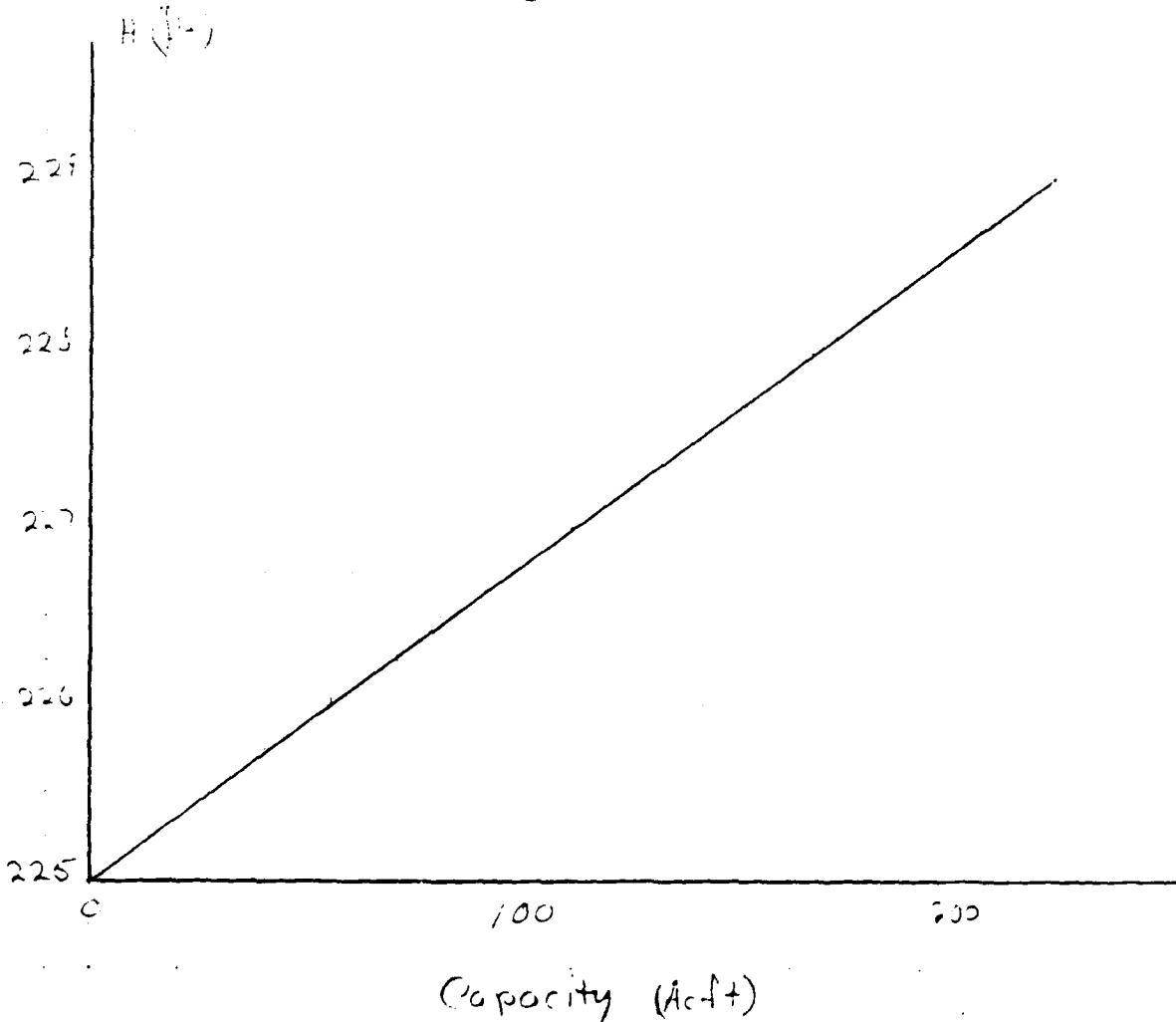
CHECKED BY _____

DATE _____

AREA - CAPACITY

Name of Dam: Aspen Fork Dam

ELEV	DEPTH	AREA	AVG. AREA	VOL	Σ VOL
225		550			0
	2	550	550	55	
226		550			55
	2	550	550	55	
227		550			110
	10	550	550	55	
228		550			165
	10	550	550	55	
229		550			220



STORCH ENGINEERS
Engineers - Landscape Architects
Planners - Environmental Consultants

JOB Phase I Dam Inspection - #4463

SHEET NO

OF

CALCULATED BY

DATE

CHECKED BY

DATE

Downstream Hydrographs

"Rule of Thumb" Guidance for Estimating Downstream Failure Hydrographs

NAME OF DAM Aspetuck Reservoir Dam

Section I at Dam

1. $S = \frac{211}{8/27 W_b \sqrt{9}} \text{ Acft}$
2. $Q_{p1} = \frac{211}{8/27 W_b \sqrt{9}} Y^{3/2} = \frac{211}{8/27(200) \sqrt{32.2}} (11)^{3/2} = 12270 \text{ cfs}$
3. See Sections

Section II at

- 4a. $H_2 = \underline{9.5'}$ $A_2 = \underline{2400 \text{ SF}}$ $L_2 = \underline{2500'}$ $V_2 = \underline{137}$ Acft
- b. $Q_{p2} = Q_{p1} (1 - V_2/S) = \underline{6865}$ cfs
- c. $H_2 = \underline{7.3'}$ $A_2 = \underline{1600 \text{ SF}}$
 $A_A = \underline{2000 \text{ SF}}$ $V_2 = \underline{115}$ Acft
 $Q_{p2} = 12270 (1 - 115/211) = 7730 \text{ cfs}$

Section III at

- 4a. $H_3 = \underline{9.1'}$ $A_3 = \underline{1650 \text{ SF}}$ $L_3 = \underline{2000'}$ $V_3 = \underline{75}$ Acft
- b. $Q_{p3} = Q_{p2} (1 - V_3/S) = \underline{4770}$ cfs
- c. $H_3 = \underline{7.2'}$ $A_3 = \underline{1150 \text{ SF}}$
 $A_A = \underline{1400 \text{ SF}}$ $V_3 = \underline{67}$ Acft
 $Q_{p3} = 7730 (1 - 67/115) = 5200 \text{ cfs}$

Section IV at

- 4a. $H_4 = \underline{7.0'}$ $A_4 = \underline{750 \text{ SF}}$ $L_4 = \underline{1500'}$ $V_4 = \underline{25.8}$ Acft
- b. $Q_{p4} = Q_{p3} (1 - V_4/S) = \underline{4180}$ cfs
- c. $H_4 = \underline{6.2'}$ $A_4 = \underline{600 \text{ SF}}$
 $A_A = \underline{675 \text{ SF}}$ $V_4 = \underline{23}$ Acft
 $Q_{p4} = 5200 (1 - 23/132) = 41300 \text{ cfs}$

STORCH ENGINEERS/STORCH ASSOCIATES
 Engineers - Landscape Architects
 Planners - Environmental Consultants

JOB _____

SHEET NO. _____

OF _____

CALCULATED BY _____

DATE _____

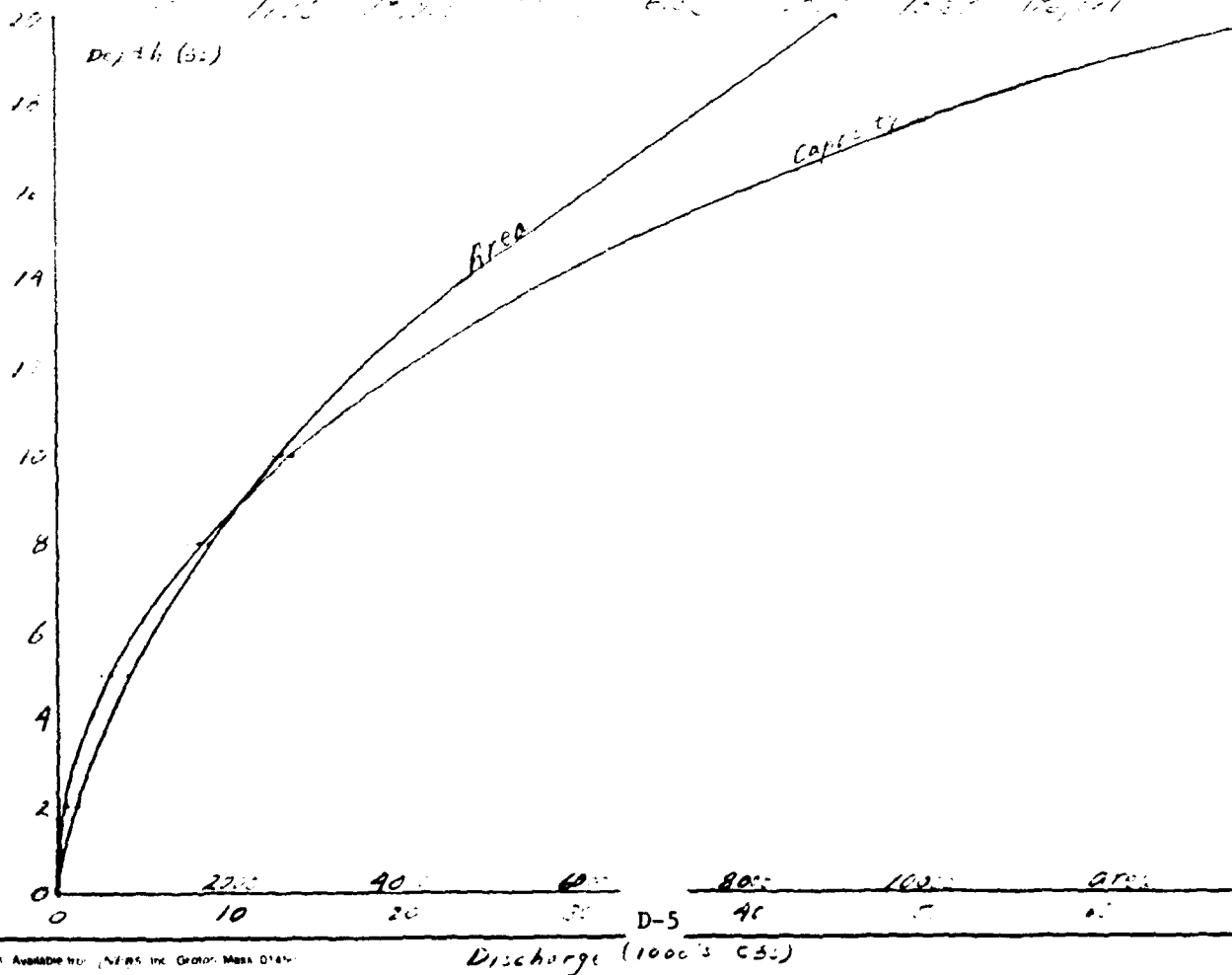
CHECKED BY _____

DATE _____

SCALE _____

Section I

D	1	2	3	4	5	6	7	8
1	100	200	300	400	500	600	700	800
2	141	282	423	564	705	846	987	1128
3	173	346	519	692	865	1038	1211	1384
4	200	400	600	800	1000	1200	1400	1600
5	224	447	670	893	1116	1339	1562	1785
6	245	490	735	980	1260	1510	1760	2010
7	263	526	790	1057	1354	1628	1892	2164
8	279	558	837	1115	1440	1744	2048	2312
9	294	588	882	1172	1512	1854	2196	2456



STORCH ENGINEERS/STORCH ASSOCIATES
Engineers - Landscape Architects
Planners - Environmental Consultants

JOB _____

SHEET NO. _____

CALCULATED BY _____

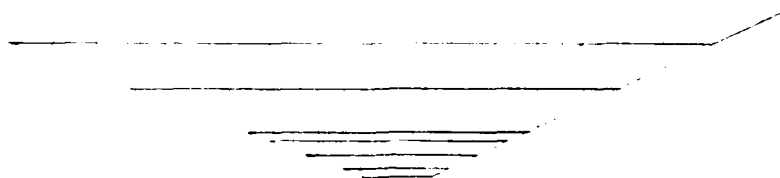
DATE _____

CHECKED BY _____

DATE _____

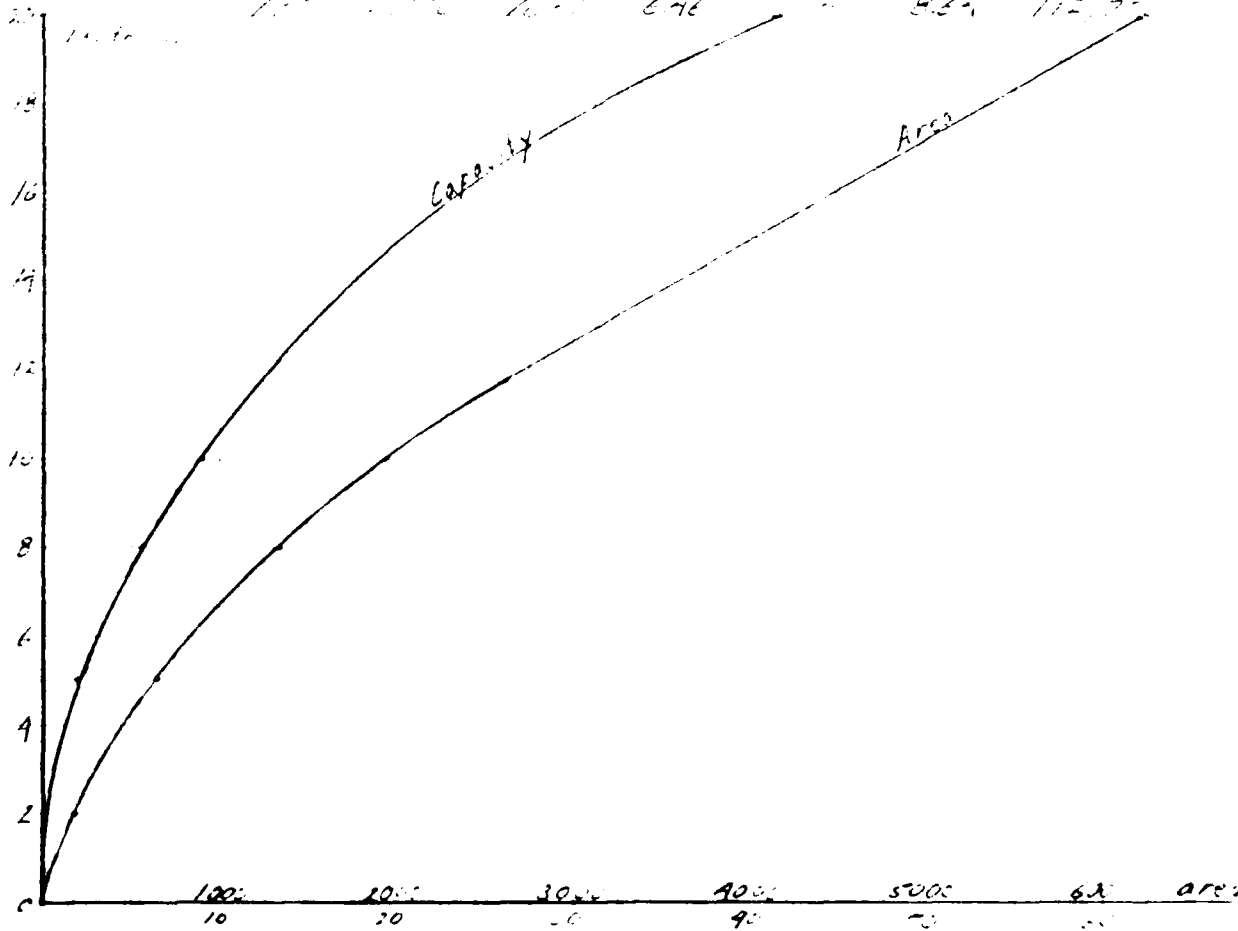
SCALE _____

Section III



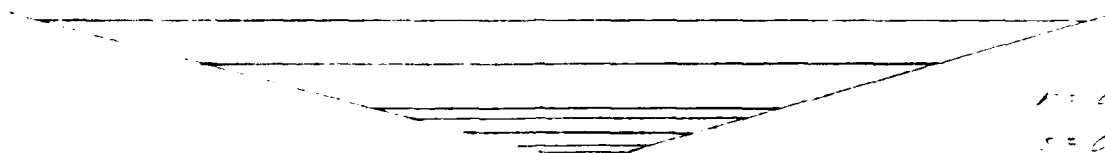
1:1
 1:0.2

C	H	V	A	I	I	I	Q
12.5	1.5	1.82	1.08	1.45	1.85	2.1	
15	2.5	2.45	2.05	1.95	2.25	2.55	
20	3.5	3.1	2.37	2.25	2.55	3.05	
30	4.5	3.75	2.67	2.55	2.85	3.55	
50	6.5	5.12	3.03	3.25	3.77	4.15	
70	8.5	6.46	3.46	3.75	4.34	4.75	



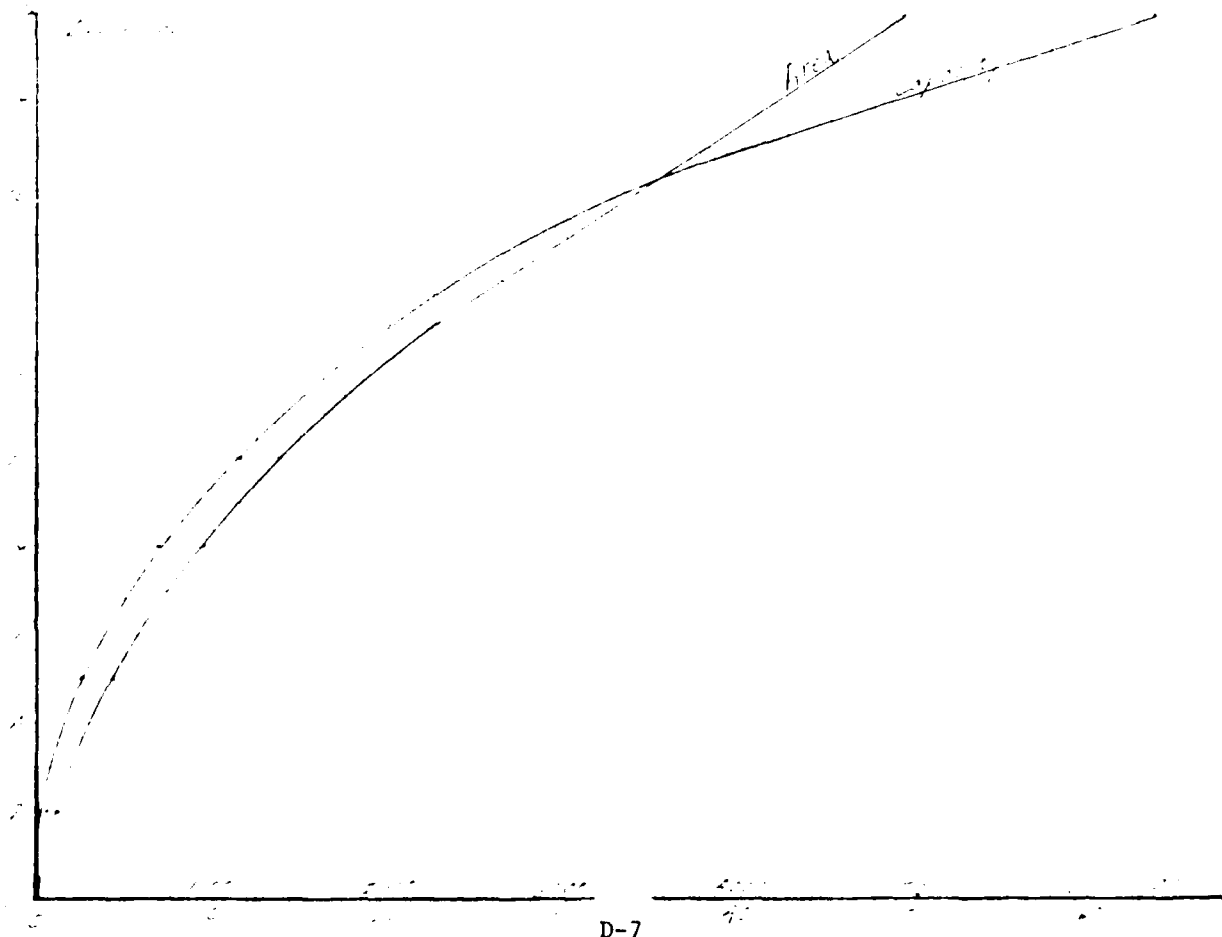
STORCH ENGINEERS/STORCH ASSOCIATES
Engineers - Landscape Architects
Planners - Environmental Consultants

JOB NO. _____
 SHEET NO. _____ OF _____
 CALCULATED BY _____ DATE _____
 CHECKED BY _____ DATE _____
 SCALE Section IV



1:1
 5:1

D	W	H	R	K ²	S ²	V	Q
1	75	120	1.71	1.43	.084	3.57	428
2	150	413	3.50	2.31	.084	5.77	2727
3	150	960	5.05	2.94	.084	7.54	7846
4	225	1375	6.11	3.34	.084	8.34	11,468
5	450	4900	11.81	5.19	.084	12.46	63,504
6	595	10,050	16.89	6.58	.084	16.43	167,122



D-7

STORCH ENGINEERS
Engineers - Landscape Architects
Planners - Environmental Consultants

JOE Phase I Dam Inspection - #4463

SHEET NO. _____ OF _____

CALCULATED BY: _____ DATE: _____

CHECKED BY: _____ DATE: _____

Downstream Hydrographs

"Rule of Thumb" Guidance for Estimating Downstream Failure Hydrographs

NAME OF DAM: Aspetuck Reservoir Dam

Section I at Dam - Water at Spillway Crest

1. $S = \frac{177.0}{8/27 W_b \sqrt{g}} \text{ Acft} \quad Y^{3/2} = 5.0 (60.1322) (5)^{3/2} = 7608 \text{ cfs}$
2. $Q_{p1} = 8/27 W_b \sqrt{g} Y^{3/2} = 5.0 (60.1322) (5)^{3/2} = 7608 \text{ cfs}$
3. See Sections

Section II at

- 4a. $H_2 = \underline{7.7'} \quad A_2 = \underline{1640 \text{ SF}} \quad L_2 = \underline{1000'} \quad V_2 = \underline{37.6} \text{ Acft}$
- b. $Q_{p2} = Q_{p1} (1 - V_2/S) = \underline{5660} \text{ cfs}$
- c. $H_2 = \underline{6.7'} \quad A_2 = \underline{1300 \text{ SF}}$
 $A_A = \underline{5700 \text{ SF}} \quad V_2 = \underline{33.7} \text{ Acft}$
 $Q_{p2} = 7608 (1 - 33.7/177) = 5660 \text{ cfs}$

Section III at

- 4a. $H_3 = \underline{6.5'} \quad A_3 = \underline{1350 \text{ SF}} \quad L_3 = \underline{1000'} \quad V_3 = \underline{33.9} \text{ Acft}$
- b. $Q_{p3} = Q_{p2} (1 - V_3/S) = \underline{4257} \text{ cfs}$
- c. $H_3 = \underline{6.0'} \quad A_3 = \underline{1100 \text{ SF}}$
 $A_A = \underline{1225 \text{ SF}} \quad V_3 = \underline{28.1} \text{ Acft}$
 $Q_{p3} = 5660 (1 - 28.1/177) = 4406$

Section IV at

- 4a. $H_4 = \underline{\hspace{1cm}} \quad A_4 = \underline{\hspace{1cm}} \quad L_4 = \underline{\hspace{1cm}} \quad V_4 = \underline{\hspace{1cm}} \text{ Acft}$
- b. $Q_{p4} = Q_{p3} (1 - V_4/S) = \underline{\hspace{1cm}} \text{ cfs}$
- c. $H_4 = \underline{\hspace{1cm}} \quad A_4 = \underline{\hspace{1cm}}$
 $A_A = \underline{\hspace{1cm}} \quad V_4 = \underline{\hspace{1cm}} \text{ Acft}$
 $Q_{p4} = \underline{\hspace{1cm}}$

APPENDIX E
INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS

10

2000

DATE
ILME